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WHO CARES AND DOES IT MATTER FOR
THE LABOUR MARKET? A LONGITUDINAL
ANALYSIS OF THE LABOUR FORCE
STATUS OF INDIGENOUS AND NON-
INDIGENOUS CARERS

B. HUNTER, M. GRAY AND H. CRAWFORD

Centre for
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Who cares and does it matter for the labour market? A longitudinal analysis of the labour force status of Indigenous and non-Indigenous carers

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Abstract

Indigenous Australians experience higher rates of severe or profound disability than other Australians, and the gap in rates of disability between Indigenous and non-Indigenous Australians increases with age. The relatively high rates of disability among the Indigenous population corresponds with heavy caring burdens. It has been well established that carers of a person with a disability have lower rates of paid employment than do noncarers. However, relatively little is known about the effect of caring on the employment rates of Indigenous carers and virtually nothing about the effect of caring on changes in labour force status. This paper uses the recently released Australian Census Longitudinal Dataset to, for the first time, describe the labour market dynamics of Indigenous and non-Indigenous carers, and the extent to which these differ from the dynamics of those who are not carers. By exploiting the longitudinal nature of the data, we can examine how labour force status changes in association with starting as a carer and exiting from caring. Employment probabilities and labour force transitions are analysed using bivariate and multivariate techniques. The analysis raises questions about how caring decisions are made within households and the extent to which the costs of caring may differ between Indigenous and non-Indigenous households.

Keywords: labour force dynamics, Indigenous employment, longitudinal data, carers, disability

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Acronyms

ACLD	Australian Census Longitudinal Dataset
ANU	The Australian National University
CAEPR	Centre for Aboriginal Economic Policy Research
PWD	person who requires care because of a disability, a long-term illness or old age

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1 Introduction

At any point in time, around 12% of the Australian working-age population is providing unpaid informal care for a person with a disability or a long-term illness, or who is too old to look after themselves (PWD for short). Unpaid carers are typically family members or friends, and provide much of the care for people with a disability. The percentage of the population that will be unpaid carers at some point in their lifetime is considerably higher than 12%.

Although there has been some Australian research into the effects on carers of providing unpaid care, including on labour market outcomes, the existing research on carers is relatively limited. For some groups, such as Indigenous Australians, there is very little research.

This paper uses longitudinal data to estimate the effect of providing unpaid care for a PWD on the rates of paid employment of Indigenous and non-Indigenous Australians. The proportion of the Indigenous population that requires care is larger than for the Australian population as a whole, and is projected to increase at a faster rate because of the effects of the structural ageing of the Indigenous population. Because the Indigenous population is much younger, on average, than the non-Indigenous population, a larger proportion of Indigenous carers are of working age. This means that understanding the effect of caring on the employment rate of Indigenous working-age carers is important, particularly in the context of substantial policy attempts to increase the employment rate of the Indigenous population.

Providing informal care has a negative effect on paid employment in a number of countries (e.g. Ettner 1996, Jenson & Jacobzone 2000, Carmichael & Charles 2003, Bittman et al. 2007, Gray et al. 2008, Gray & Edwards 2009, Leigh 2010). The most convincing Australian estimates of the effect of informal care on paid employment are those of Leigh (2010), who found that providing informal care reduces the probability of being in paid employment by 4–6 percentage points. An important point made by Leigh is that estimates of the effect of informal care on paid employment made using cross-sectional data substantially overstate the negative effect of caring on paid employment, primarily because carers had, on average, lower rates of paid employment before commencing caring,¹ and can thus be very misleading.

Very little research is available on the effect of informal care on the employment rates of Indigenous people and whether the effects on employment for Indigenous and non-Indigenous carers are different. The only longitudinal

analysis that we are aware of is by Biddle and Crawford (2015), who found that, using Australian longitudinal census data, providing informal disability care was positively associated with acquiring a certificate-level qualification, with a larger effect among the Indigenous than the non-Indigenous population (after controlling for a small set of observable characteristics). Another relevant finding in the context of this paper is that Biddle and Crawford (2015) found that there was a larger drop in the probability of becoming employed in 2011 (following a period outside the workforce) for Indigenous people who were carers in 2006 than for carers in the total population.

Linking data from the 2011 Census to a 5% sample of the 2006 Census to create the Australian Census Longitudinal Dataset (ACL) allows the first longitudinal analysis of labour market outcomes for Indigenous informal carers and analysis of the extent to which the effect of informal care on the Indigenous population differs from the effect on the non-Indigenous population. Census data also include information on the provision of child care, which is important to distinguish from care for a PWD. For the remainder of this paper, we will refer to child care and carer of a PWD.

The remainder of this paper is structured as follows:

- Section 2 provides an overview of the ACLD data and the statistical methods used to estimate the effect of informal care on paid employment.
- Section 3 describes the labour force status of Indigenous carers and how this compares with non-Indigenous carers.
- Section 4 presents the results of the multivariate analysis of the impact of caring on labour force status.
- Section 5 presents the results of a regression analysis of the probability of employment.
- Section 6 describes labour market endowments, and carer and employment transitions.
- Section 7 provides conclusions from the analyses.

2 Data and empirical approach

Australian Census Longitudinal Dataset

The ACLD links a 5% random sample of data from the 2006 Census with data from the 2011 Census, using data linkage techniques.² The ACLD includes linked census data for 800 759 individuals – of whom 14 802 identified as being Indigenous in 2006.³ This number represents substantially less than 5% of the Indigenous population, but nonetheless forms the largest available longitudinal dataset of Indigenous Australians (ABS 2013). Indigenous identification changed substantially between 2006 and 2011 among the linked sample. Of those who identified as being Indigenous in 2006, 9.2% identified as being non-Indigenous in 2011 and 1.1% did not state their Indigenous status. Of those who identified as being non-Indigenous in 2006, 0.2% identified as Indigenous in 2011 and 0.9% did not state a response (ABS 2013). The instability in the identification of Indigenous status presents a challenge for analysis and interpretation of the data, particularly when trying to compare changes over time from two cross-sectional datasets. One advantage of the ACLD is that the group of individuals (however defined) whose characteristics and outcomes are being compared over time can be held constant. In this paper, we have defined Indigenous status as measured by the 2006 Census.

The analysis is restricted to people aged 20–59 years in 2006, to ensure that all respondents were in the working-age population in both 2006 and 2011, and so that we could focus on the post-secondary school population.

The 2006 and 2011 censuses both included a question about whether each person in the household aged 15 and over provided unpaid care or assistance to family members or others because of disability, a long-term illness or problems related to old age. The question includes the instruction that recipients of Carer Allowance or Carer Payment should state that they provided unpaid care, and that unpaid help provided through a voluntary organisation or group should not be included. The question on the provision of unpaid care was the same in both censuses.

The strength of the ACLD for estimating the effect of informal care on the employment of Indigenous carers is that it includes a relatively large longitudinal sample of carers (68 300 carers in 2006, 78 000 in 2011, and 25 200 in both 2006 and 2011) and thus allows the effect of changes in carer status on paid employment to be estimated. The data source does, however, have several limitations. First, there is information for only two time

points, so, because no information is provided on the start or end point of caring, it is not possible to analyse how labour force status of carers changes with duration of providing informal care. Second, it does not provide information on the intensity of care provided (e.g. number of hours) or the predictability of the caring requirements, which can be important in determining the effect of caring on paid employment. Third, information is available five years apart and so the analysis of changes in labour force status relative to the timing of commencing or finishing caring is a little crude.

Empirical approach and statistical methods

The basic empirical approach is to estimate the probability of moving into or out of employment, or not changing employment status between 2006 and 2011, according to carer status in 2006 and 2011. We first analyse differences in employment rates⁴ and changes in employment rates for various population groups identified in the ACLD data, and then provide some multivariate analyses of the probability of employment, taking into account observable characteristics of the population.

This multivariate approach is operationalised by estimating regression models of the probability of being employed in 2011 for eight subpopulations, defined according to caring status in 2006 and 2011, and employment status in 2006. The basic empirical strategy is summarised in Table 1. The probability of being employed in 2011 is estimated using a logit model (Greene 2008).

An alternative modelling strategy is to use the longitudinal nature of the ACLD data to take into account unobserved differences between individuals that may affect both their employment status and their likelihood of being an informal carer (i.e. unobserved heterogeneity). Two options are to estimate using a random effects or a fixed effects model. However, there is potential for bias in nonlinear discrete choice models when the number of time points is small.⁵ For this reason, we chose to estimate the probability of employment using a cross-sectional logit model, but to use the longitudinal nature of the data to control for caring and employment status in 2006.

The explanatory variables included in the regression modelling are gender, age (and age squared), educational attainment, whether the respondent has a disability, region of residence and provision of unpaid child care. These variables are consistent with the basic set of human capital, demographic and geographic controls used in previous census analyses of employment (Gray

& Hunter 2002).⁶ Although the earlier census analyses controlled for education, age, gender, remoteness and some other socioeconomic characteristics, they did not control for carer and disability status, because such information was not collected at the time. Our analysis focuses on such factors, and distinguishes between the effect of child care and providing care for a PWD.

The logistic regression models are estimated using maximum likelihood estimation techniques. When the explanatory variables are also categorical, the coefficients in a logistic model must be interpreted as relative to a reference person defined by the omitted categories of the respective groups of explanatory variables. The reference person, or base case in the following binary logistic regression analysis, is a non-Indigenous male without a disability who does not care for any children, has not completed education to Year 12 and resides in a major urban area.

Estimating separate regression models for the subpopulations has the advantage that carer status is taken as given for each model.⁷ However, policymakers are interested in comparing the prospect of employment for carers with noncarers. Arguably, separate regression models complicate such comparisons because each model includes a different 'scaling' parameter. To facilitate such comparisons, a summary regression of the whole ACLD population is provided in Section 5. The summary regression is based on a larger sample and has relatively small standard errors. More importantly, it provides an estimate of the employment differences between various groups of carers. However, it does not include employment status in 2006 as an explanatory variable, because this would necessitate the move to a formal dynamic regression model that is beyond the scope of this paper (and is probably not sustainable, given existing data).

TABLE 1. Empirical approach to estimate employment transitions of carers, controlling for carer status and change in carer status

Model	Carer status in 2006 and 2011	Labour force status in 2006	Employment transition
Model 1	Carer of a PWD in both censuses	Not employed	Probability of moving into employment by 2011 versus remaining not employed
Model 2		Employed	Probability of remaining employed in 2011 versus leaving employment by 2011
Model 3	Became a carer of a PWD	Not employed	Probability of moving into employment by 2011 versus remaining not employed
Model 4		Employed	Probability of remaining employed in 2011 versus leaving employment by 2011
Model 5	Ceased being a carer of a PWD	Not employed	Probability of moving into employment by 2011 versus remaining not employed
Model 6		Employed	Probability of remaining employed in 2011 versus leaving employment by 2011
Model 7	Not a carer of a PWD in either census	Not employed	Probability of moving into employment by 2011 versus remaining not employed
Model 8		Employed	Probability of remaining employed in 2011 versus leaving employment by 2011

3 Cross-sectional analysis of caring for a PWD and labour force status

According to the 2011 Census, the rate of caring for a PWD is slightly higher among the Indigenous working-age population than among the non-Indigenous working-age population. It is estimated that 19% of Indigenous females were carers compared with 15% of non-Indigenous females, and that 13% of Indigenous males were carers compared with 10% of non-Indigenous males (Table 2). It is evident that for both the Indigenous and non-Indigenous populations, males are less likely to be a carer than are females.

Table 3 provides information on the labour force status in 2011 of carer status, gender and Indigenous status. Indigenous and non-Indigenous carers of a PWD have a lower employment rate than those who are not carers. The employment rate of non-Indigenous female carers

of a PWD is 61%, and 71% for those without caring responsibilities. For non-Indigenous male carers the employment rate is 75%, compared with 83% for those without caring responsibilities.

Indigenous women with caring responsibilities have an employment rate of 41%, lower than the employment rate of 48% for those without caring responsibilities. Indigenous men with caring responsibilities have an employment rate of 51%, compared with 60% for those without caring responsibilities.

For all groups (Indigenous, non-Indigenous, male and female), the proportion of employment that is part-time is larger among carers than it is among those without caring responsibilities, although the differences are not dramatic. For all groups, carers are more likely to be not in the labour force compared with those without caring responsibilities.

TABLE 2. Proportion of population that are carers for a PWD, 2011

Population	Indigenous		Non-Indigenous	
	Female	Male	Female	Male
Proportion of population that are carers of a PWD	19%	13%	15%	10%
Number of carers of a PWD	24 514	14 051	913 511	547 606

Note: Population is aged 20–64 years. These data exclude a small number of people who did not state their labour force status.
Source: TableBuilder, 2011 Census

TABLE 3. Labour force status by carer (PWD) status, gender and Indigenous status, 2011

Labour force status	Indigenous		Non-Indigenous	
	Carer for a PWD	Not providing care for a PWD	Carer for a PWD	Not providing care for a PWD
Female				
Total employed	41%	48%	61%	71%
<i>Employed, worked full-time</i>	21%	28%	29%	40%
<i>Employed, worked part-time</i>	20%	20%	32%	31%
Unemployed	9%	8%	4%	4%
Not in the labour force	50%	44%	35%	25%
Total	24 514	104 329	913 511	5 042 315
Male				
Total employed	51%	60%	75%	83%
<i>Employed, worked full-time</i>	37%	47%	61%	70%
<i>Employed, worked part-time</i>	14%	13%	14%	13%
Unemployed	14%	11%	5%	4%
Not in the labour force	35%	29%	20%	13%
Total	14 051	98 239	547 606	5 177 424

Note: Population is aged 20–64 years.
Source: TableBuilder, 2011 Census

4 Longitudinal analysis of the relationship between caring for a PWD and employment

One way of estimating the impact of caring on rates of paid employment is to calculate the changes in employment rates that are associated with changes in caring status, and how these compare with the employment changes for people who do not change their caring status.

Information is provided on employment rates in 2006 and 2011 for four carer transitions:

- carer of a PWD in both 2006 and 2011
- not a carer of a PWD in 2006, carer of a PWD in 2011 (transitioned into caring/became carers)
- carer of a PWD in 2006, not a carer of a PWD in 2011 (transition out of caring/ceased providing care)
- not a carer of a PWD in either 2006 or 2011.

The data are presented by Indigenous status and gender. Employment rates in 2006 and 2011 are reported in Table 4, and changes in employment rates between 2006 and 2011 for each carer transition are reported in Figures 1–4.

For those who were a carer in both 2006 and 2011, employment increased by 5 percentage points for Indigenous women but decreased by 5 percentage points for Indigenous men. There was a small decline for non-Indigenous women (1 percentage point) and a substantial decline for non-Indigenous men (5 percentage points) (Figure 1).

Those who became carers of a PWD in 2011 have, on average, a lower employment rate before becoming a carer of a PWD than do people who were not a carer of a PWD in either 2006 or 2011. This is the case for Indigenous women and non-Indigenous women and men, although Indigenous men who became carers had a very similar employment rate to those without caring responsibilities.

For all groups examined, there is also a decrease in employment rate associated with commencing caring by 2011. The decrease in employment rates associated with commencing caring was larger for men than women (Figure 2). The employment rate decreased by 13 percentage point for Indigenous men and by 7 percentage points for non-Indigenous men. The decrease was 3 percentage points for Indigenous women and 4 percentage points for non-Indigenous women.

TABLE 4. Employment rates (%) in 2006 and 2011 by carer of a PWD status in 2006 and 2011, by Indigenous status and gender

Carer of a PWD status	Indigenous		Non-Indigenous	
	Female	Male	Female	Male
Carer in 2006 and 2011				
Employment rate 2006	45.6	49.1	59.7	76.1
Employment rate 2011	50.7	44.3	58.4	70.6
Not a carer 2006, carer 2011				
Employment rate 2006	48.4	66.7	68.8	84.1
Employment rate 2011	45.4	53.3	64.5	77.4
Carer 2006, not a carer 2011				
Employment rate 2006	50.6	68.5	63.2	79.7
Employment rate 2011	50.6	62.9	65.9	79.1
Not a carer in 2006 or 2011				
Employment rate 2006	50.9	68.4	72.4	86.4
Employment rate 2011	52.4	65.9	73.0	85.2

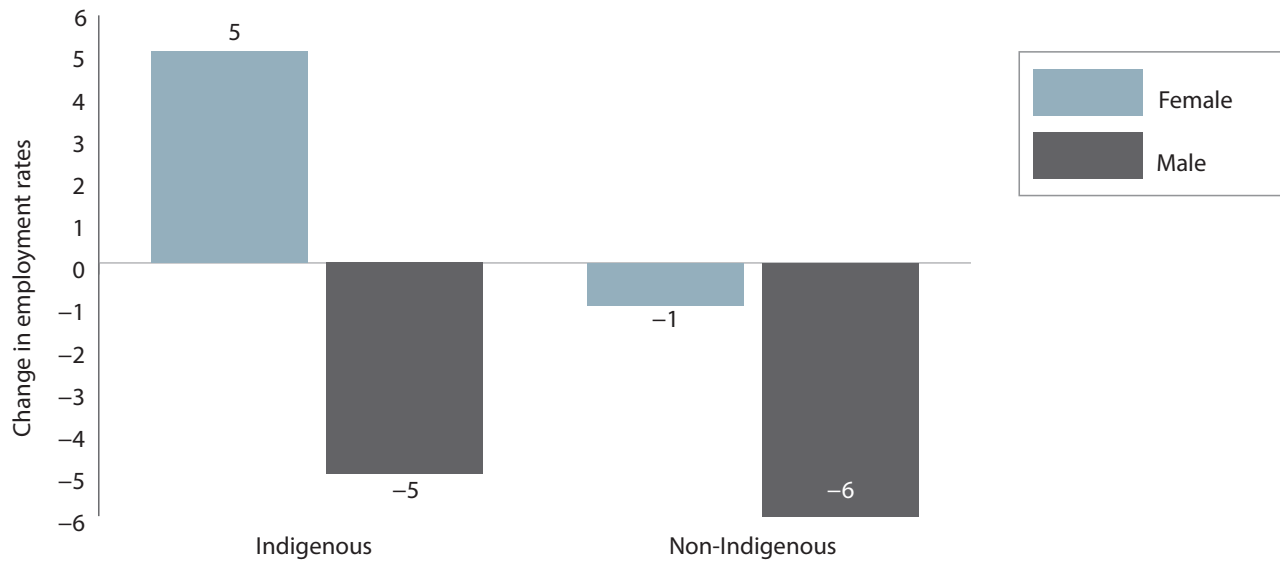
Notes: Population is aged 20–59 years in 2006 and 25–64 years in 2011. Age range was chosen to ensure that the population was of working age in both 2006 and 2011. Indigenous status according to what was reported on the 2006 Census.

Source: Author calculations based on the ACLD 2006–11, which was accessed through the Australian Bureau of Statistics data laboratory.

These data suggest that the lower employment rates of carers is partly because of a lower pre-caring employment rate and partly because of a decrease in employment following the commencement of caring. That is, part of the correlation of caring for a PWD on employment rates is a selection effect and part of it

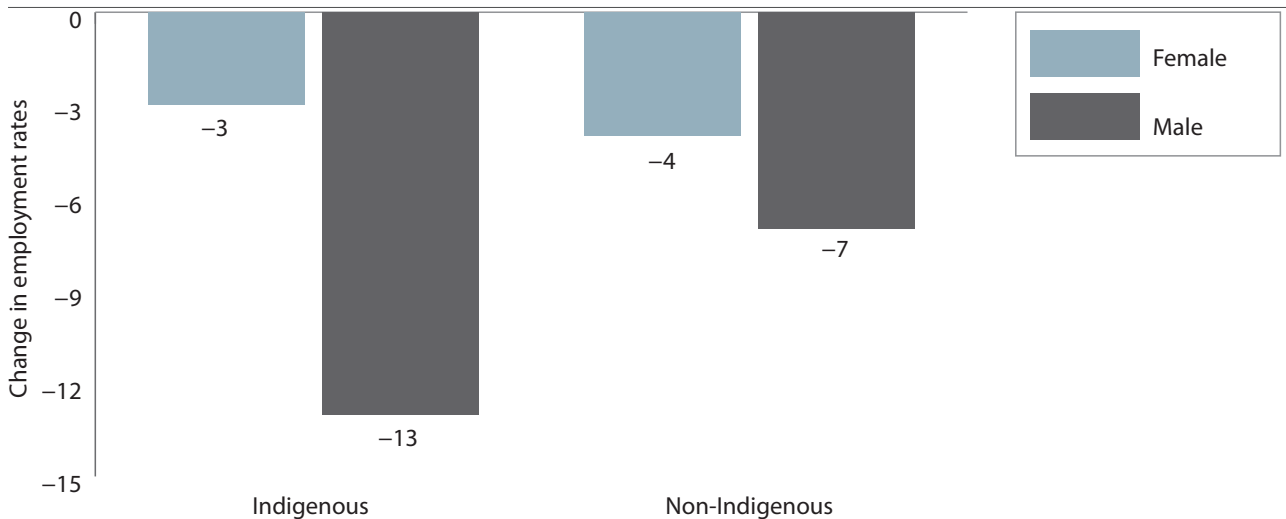
appears to be due to the ‘impact’ of caring. The extent to which caring has a negative causal impact on the likelihood of being in paid employment is more effectively tested statistically using fixed effects models and the results (see Section 4).

FIG. 1. Changes in employment rates between 2006 and 2011, people who were a carer of a PWD in both 2006 and 2011



Notes: Population is aged 20–59 years in 2006. Indigenous status is according to what was reported on the 2006 Census.
Source: Author calculations based on the ACLD 2006–11, which was accessed through the Australian Bureau of Statistics data laboratory. See Table 4.

FIG. 2. Changes in employment rates between 2006 and 2011, people who became a carer of a PWD between 2006 and 2011

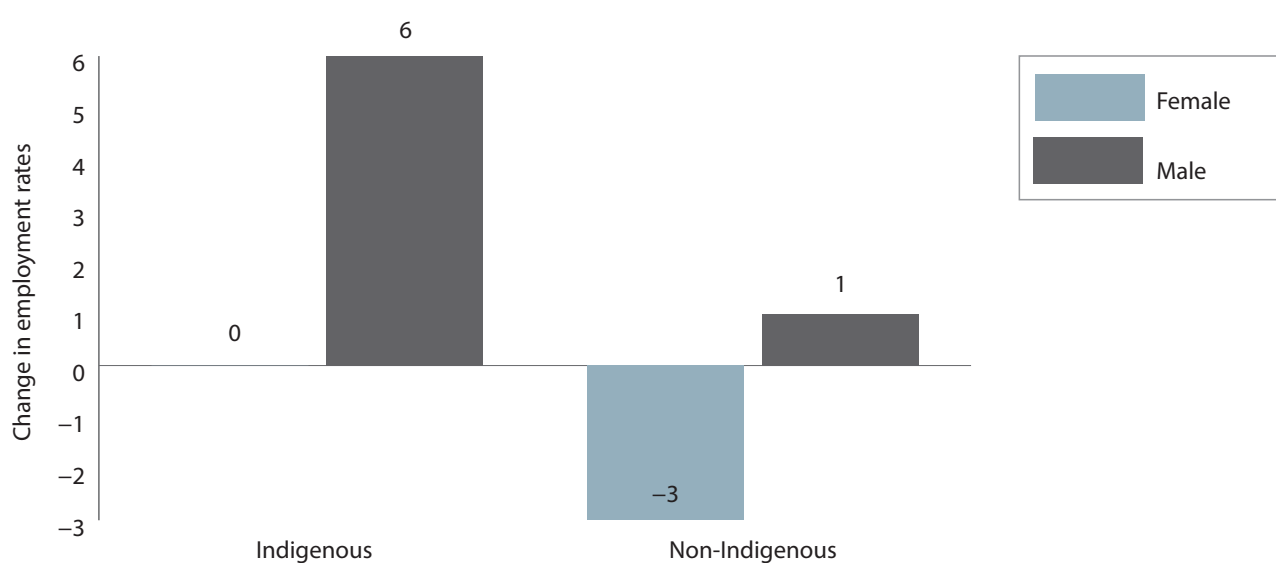


Notes: Population is aged 20–59 years in 2006. Indigenous status is according to what was reported on the 2006 Census.
Source: Author calculations based on the ACLD 2006–11, which was accessed through the Australian Bureau of Statistics data laboratory. See Table 4.

The pattern in changes in employment rates between 2006 and 2011 for those who ceased providing care between 2006 and 2011 are less clear. Average employment rates for Indigenous women did not change, whereas employment rates for Indigenous men increased by 6 percentage points. In the non-Indigenous population, employment rates for women declined 3 percentage points and increased 1 percentage point for men (Figure 3).

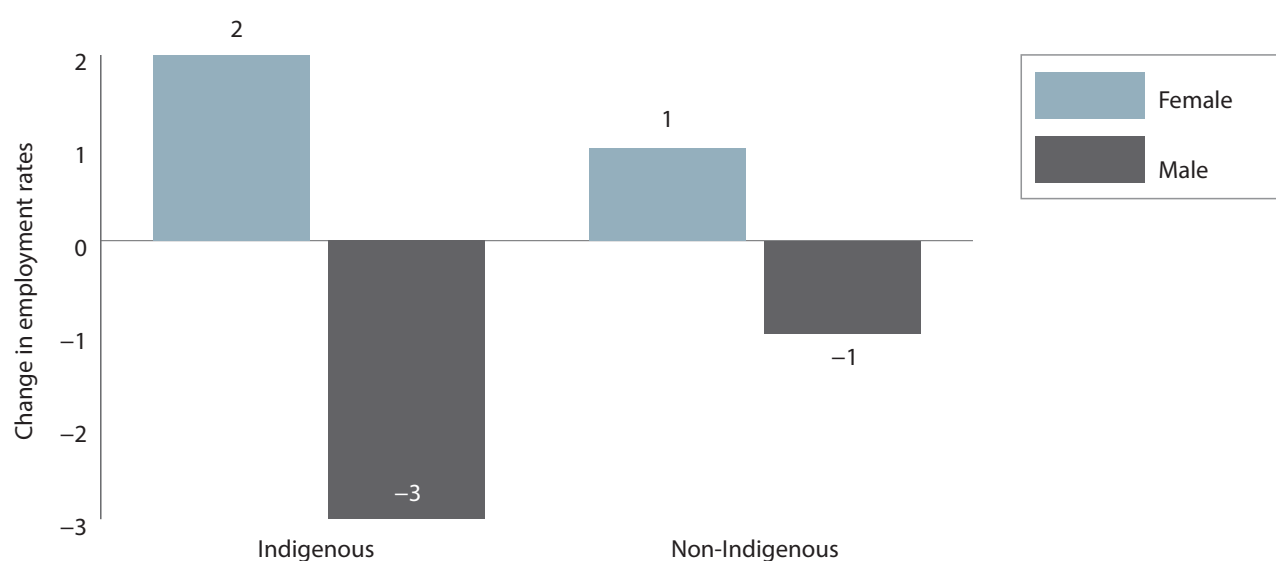
For the majority of the population that were not a carer in either 2006 or 2011, employment rates increased slightly for Indigenous and non-Indigenous women, and decreased slightly for non-Indigenous men. For Indigenous men, there was a larger decline in employment rates of 3 percentage points (Figure 4).

FIG. 3. Changes in employment rates between 2006 and 2011, people who ceased providing care for a PWD between 2006 and 2011



Notes: Population is aged 20–59 years in 2006. Indigenous status is according to what was reported on the 2006 Census.
Source: Author calculations based on the ACLD 2006–11, which was accessed through the Australian Bureau of Statistics data laboratory. See Table 4.

FIG. 4. Changes in employment rates between 2006 and 2011, people who were not a carer of a PWD in either 2006 or 2011



Notes: Population is aged 20–59 years in 2006. Indigenous status is according to what was reported on the 2006 Census.
Source: Author calculations based on the ACLD 2006–11, which was accessed through the Australian Bureau of Statistics data laboratory. See Table 4.

An alternative way of analysing the employment effect associated with caring for a PWD is to compare the employment transitions of those with and without caring responsibilities. Irrespective of carer status, Indigenous status or gender, those who were employed in 2006 were more likely to be employed in 2011 (Table 5). Given that we condition on employment status in 2006, the employment probability can be read as a transition rate. For example, if you were employed in 2006, the entry in the table provides an indication of the probability that you remained employed (measured as a percentage). If you subtract this probability from 100, then the table entry provides information on the transition out of employment. Similarly, if you were not employed in 2006, then the employment probability for 2011 indicates the transition into employment between the past two censuses.

The first thing that is evident from Table 5 is that the probability of remaining in employment is lower for most Indigenous estimates compared with the analogous non-Indigenous estimates. The exception to this rule is Indigenous females who provided care at the past two censuses. They are not that different, in terms of transition probabilities, from the non-Indigenous females providing care in both 2006 and 2011 – indeed, the probability of staying employed is actually slightly higher for Indigenous women (83%, compared with 81% for non-Indigenous women). Further evidence that this group of Indigenous female carers is not different from non-Indigenous female carers is that among those who were not employed in 2006, 24% made the transition into employment by 2011 from both groups of female carers.

For Indigenous males who provided care to a PWD in both 2006 and 2011, the probability of remaining employed is 17 percentage points less than the analogous group of non-Indigenous male carers (69% and 86%, respectively), but the transition into employment is only 1 percentage point less. This indicates that Indigenous males have the capacity to remain employed while providing unpaid care.

To discern the effect of providing care to a PWD on employment status, we need to compare those who were not carers in either census with the various categories of carers. With one exception, those that provide care over time tend to have a lower probability of remaining employed and a lower probability of entering employment between 2006 and 2011 than those who did not provide care at either point in time. For those who were employed in 2006, the differential between the 2011 employment rates for carers and noncarers tends to be less for the non-Indigenous population than for the Indigenous population. Again, the estimates for Indigenous female carers in both 2006 and 2011 are particularly noteworthy.

The probability of remaining employed for Indigenous female carers is 9 percentage points higher than for Indigenous females who did not provide care (83% and 74%, respectively). However, the probability of entering employment is substantially lower for this group of Indigenous female carers compared with noncarers (24% and 30%, respectively). In our opinion, the relatively higher probability of remaining employed among this group of female Indigenous carers is probably because of better educational endowments and higher age.

5 Regression analysis of probability of employment

The estimates reported in Section 4 of the associations between caring for a PWD and paid employment, and the extent to which the associations differ between the Indigenous and non-Indigenous population does not take into account differences in demographic and human capital characteristics.

This section presents the results of estimates of the extent to which the changes in employment rates between 2006 and 2011, according to caring status in 2006 and 2011, differs between the Indigenous and non-Indigenous populations. As outlined in Section 2, separate models are estimated according to caring status in 2006 and 2011, and whether the individual was in paid employment in 2006. This allows estimation of the extent to which changes in paid employment status between 2006 and 2011 differs for the Indigenous and non-Indigenous populations.

The regression results are presented as marginal effects, which are calculated as the change in the probability of employment in 2011 associated with a unit change in an explanatory variable (holding all other variables at their mean value).

Of the eight logistic models estimated, all have either an adequate ability to correctly predict outcomes within the sample or a reasonably high concordance statistic.⁸ The coefficients estimated are consistent with the expectation from economic theory (see Table A1).

Increases in education attainment are estimated to be associated with a higher rate of paid employment in 2011 for all eight models. Having a disability is associated with significantly lower employment rates in 2011. To illustrate the magnitude of the differences, Table 6 reports the marginal effect of explanatory variables on the probability of employment, holding other variables at their average value.

TABLE 5. Employment rates in 2011 (%) by Indigenous status, gender, carer (PWD) status and employment status in 2006

Status in 2006	Female		Male	
	Carer of a PWD	Not a carer of a PWD	Carer of a PWD	Not a carer of a PWD
Indigenous				
Carer of a PWD				
Employed	83	66	69	75
Not employed	24	35	21	36
Not a carer of a PWD				
Employed	62	74	62	80
Not employed	29	30	36	36
Non-Indigenous				
Carer of a PWD				
Employed	81	83	86	88
Not employed	24	36	22	43
Not a carer of PWD				
Employed	79	85	85	91
Not employed	33	42	36	48

Note: Population is aged 20–59 years in 2006.

Source: Author calculations based on the ACLD 2006–11, which was accessed through the Australian Bureau of Statistics data laboratory.

Being Indigenous is estimated to reduce the probability of being employed in 2011 for those who became a carer for a PWD, those who ceased being a carer of a PWD and those who were not a carer of a PWD in both censuses. The estimated negative effect of being Indigenous on the probability of being employed is substantial. For those who were a carer for a PWD in both censuses, no difference was found between Indigenous and non-Indigenous.

Having a core disability is one of the strongest predictors of low employment rates, as is being female. Although education tends to be the second largest factor associated with employment probabilities in 2011, there is significant variation in the returns to education in the various subpopulations. That is, the benefits of education can vary significantly among various subpopulation groups, after conditioning on carer status and employment status in 2006. Being a carer takes time and reduces the ability to find and secure work, irrespective of the level of educational attainment. Table 7 provides the marginal effects for the logistic models, to indicate the relative importance of various explanatory factors in terms of magnitude of effect.

We are confident that the results in Table 7 are balanced and accurate estimates of the effect of explanatory variables on employment probabilities.⁹ Although this

regression analysis conditions on employment status and carer status in the past two censuses, it involves estimates from eight subpopulations, which entails a loss of efficiency and makes it difficult to summarise the overall findings. Table 6 provides a summary cross-sectional model of employment in 2011, using a basic logistic model.¹⁰

In broad terms, the marginal effects reported in Table 6 are consistent with those of the regression analysis. In contrast to Table 7, the marginal effects in Table 6 do not use information on employment status in 2006, but nonetheless demonstrate a significant negative correlation between providing care to a person with a disability and employment. For example, providing this form of care in both the 2006 and 2011 censuses is associated with a 9 percentage point lower employment prospect for both the Indigenous and non-Indigenous population relative to those who did not provide care in either census. Perhaps one issue is that becoming a carer of a PWD is associated with a somewhat high level of employment disadvantage in the Indigenous population. However, ceasing being a carer is not associated with any significant employment effect for the Indigenous population. Therefore, the higher incidence of caring in the Indigenous population does not, on balance, appear to be a major source of employment disadvantage.

TABLE 6. Marginal effects of explanatory variables from the summary model of employment in 2011

Variable	Indigenous		Non-Indigenous	
	Marginal effect	Z-statistic	Marginal effect	Z-statistic
Female	-15%	-10.7	-12%	-89.6
Age	5%	9.0	4%	91.8
Age squared	0%	-8.9	0%	-100.9
Degree	34%	23.5	14%	103.2
Diploma	25%	13.7	10%	65.5
Certificate	25%	16.9	9%	64.2
Year 12 completed	14%	7.3	4%	24.1
Disability	-51%	-22.2	-62%	-130.6
Regional area	-6%	-3.5	0%	1.8*
Remote area	-10%	-4.8	6%	13.8
Child care	-4%	-2.3	-7%	-45.7
Carer of a PWD in both censuses	-9%	-2.7	-9%	-25.5
Became carer of a PWD	-10%	-4.1	-6%	-24.7
Ceased as carer of a PWD	-2%	-0.8*	-4%	-14.3
Number of observations	5 356	na	395 157	na
C-statistic	0.74	na	0.75	na

na = not applicable

Notes: Population is aged 20–59 in 2006. Almost all marginal effects are significant at the 5% level, except for estimates with Z-statistics that are marked with an asterisk. The reference person is a non-Indigenous male without a disability who does not care for any children, has not completed education to Year 12, resides in a major urban area and did not provide care to a person with a disability in either 2006 or 2011.

Source: Author calculations based on the ACLD 2006–11, which was accessed through the Australian Bureau of Statistics data laboratory.

TABLE 7. Marginal effects of explanatory variables on the probability of employment (%) in 2011

Variable	Carer of a PWD in both censuses		Became a carer of a PWD		Ceased being a carer of a PWD		Not a carer of a PWD in either census	
	Not- employed	Employed	Not- employed	Employed	Not- employed	Employed	Not- employed	Employed
	in 2006	in 2006	in 2006	in 2006	in 2006	in 2006	in 2006	in 2006
Female	1	-4	-7	-6	-10	-5	-10	-6
Age	4	5	3	5	5	3	4	3
Age squared	-5	-6	-4	-5	-8	-4	-6	-3
Degree	28	7	26	9	28	6	29	4
Diploma	18	4	21	6	21	5	21	3
Certificate	20	4	18	5	20	4	22	2
Year 12 completed	4	3	8	2	4	2	8	0
Disability	-15	-31	-25	-36	-32	-51	-38	-50
Indigenous	-4	-1	-7	-13	-8	-11	-14	-8
Regional area	3	1	3	-1	3	0	2	0
Remote area	9	1	7	0	11	1	12	1
Child care	2	-3	-1	-3	-7	-4	-7	-5

Notes: The marginal effects are the change of the probability of employment in 2011 associated with a unit change in the explanatory variable, holding all other variables at their mean values. For age squared, the marginal effects have been multiplied by 100. Bolded marginal effects are not significant at the 5% level, using robust standard errors.

Source: Author calculations based on the ACLD 2006–11, which was accessed through the Australian Bureau of Statistics data laboratory.

6 Labour market endowments of carers of a PWD and employment transitions

The effect of care-giving on labour market outcomes (and vice versa) can be conceptualised as a time allocation problem in which an individual has to allocate time across work, leisure and care-giving activities (Wolf & Soldo 1994). Economic theory suggests that caring will be done by the family members with the lowest value of their alternative time use.¹¹ The argument is that the time cost of providing care may result in lost wages that reduces family income and hence diminishes the wellbeing of family members (what economists call 'utility'). This issue is considered indirectly in this section by looking at labour market endowments and employment transitions by carer (PWD) status.

When a range of demographic and human capital variables are examined, Indigenous people who stated that they provided care for a PWD in both the 2006 and 2011 censuses tended to have a higher level of education than other groups classified by their carer (PWD) status (Table 8). For example, more than 13% of Indigenous people who provided care for PWD in both censuses had a degree, which was almost twice the prevalence of degrees among those who did not provide care in 2011 (of whom about 7% had degrees). Even among Indigenous people who became carers between the 2006 and 2011 censuses, fewer than 9% had a degree in 2011. The pattern is also evident for other post-school qualifications (i.e. diplomas and certificates), with the Indigenous carers of a PWD at the time of the past two censuses tending to be more educated than other Indigenous people. However, this pattern was not evident for the non-Indigenous population; for that population, people who provided care for a PWD in the 2006 and 2011 censuses were less likely to have a degree or certificate than other non-Indigenous groups. Notwithstanding, it is important to remember that Indigenous education outcomes are substantially less than all non-Indigenous groups in Table 8.

These findings for Indigenous people are consistent with those of Biddle and Crawford (2015), who showed that providing care to a PWD was associated with a higher probability of gaining an educational qualification. Biddle and Crawford speculated that the nature of care provided may be intermittent enough to allow for study (unlike child care, which may be more intensive).

The patterns in Indigenous educational outcomes by carer status appear to be inconsistent with the economic theories that suggest that care should be done by people with the lowest value of their alternative time use. Within

an Indigenous household, having a degree is relatively uncommon, and those with a degree are more likely to be able to secure employment and be paid a high wage when employed. However, the evidence for non-Indigenous carers appears to be more consistent with the economic theory. We will return to this observation in the conclusion.

One reason for the high rates of education is that carers tend to be slightly older than noncarers. This may be because they are looking after an older partner or member of the household. Another salient observation in the context of this paper is that there is considerable correlation in the prevalence of care for a PWD and the provision of child care.

7 Concluding remarks

Several key findings have emerged from the analyses in this paper:

- In the short to medium term, providing unpaid care to a person with a disability is associated with substantially lower employment outcomes for Indigenous and non-Indigenous Australians, and for men and women
- The effect on paid employment of providing care is greater for Indigenous men than it is for other groups (Indigenous women, and non-Indigenous men and women).
- Indigenous men who cease being a carer for a PWD experienced a substantial increase in employment, unlike other groups.
- The impacts of caring on the probability of being in paid employment are negative, but are relatively small for Indigenous women vis-à-vis non-Indigenous women.
- The estimated effect of caring on the employment rates of non-Indigenous Australians is broadly consistent with the finding of Leigh (2010), who used data from the Household, Income and Labour Dynamics in Australia Survey to estimate the effect of caring.

Indigenous Australians are more likely to be unpaid carers for a person with a disability than are non-Indigenous Australians. This caring has a particularly large negative effect on the likelihood of Indigenous men being in paid employment and is thus a significant factor underpinning the labour market disadvantage of Indigenous men.

TABLE 8. Population-weighted summary statistics for 2011 information by carer status (PWD)

Variable	Indigenous				Non-Indigenous			
	Carer of a PWD in both 2006 and 2011	Became a carer of a PWD	Ceased being a carer of a PWD	Not a carer of a PWD in either census	Carer of a PWD in both 2006 and 2011	Became a carer of a PWD	Ceased being a carer of a PWD	Not a carer of a PWD in either census
Employed 2011	0.472	0.462	0.491	0.542	0.518	0.601	0.580	0.671
Female	0.713	0.639	0.664	0.531	0.669	0.581	0.586	0.485
Age (years)	45	43	43	42	51	47	48	44
Age squared	2120	1917	1943	1857	2640	2306	2384	2047
Degree	0.133	0.085	0.073	0.071	0.221	0.236	0.225	0.232
Diploma	0.091	0.047	0.057	0.051	0.119	0.115	0.109	0.096
Certificate	0.196	0.191	0.184	0.185	0.169	0.195	0.182	0.200
Year 12 completed	0.090	0.140	0.144	0.154	0.133	0.153	0.149	0.178
Disability	0.065	0.053	0.081	0.069	0.048	0.044	0.060	0.053
Indigenous	0.964	0.953	0.956	0.953	0.003	0.003	0.002	0.002
Regional area	0.548	0.440	0.420	0.420	0.306	0.297	0.299	0.280
Remote area	0.140	0.255	0.256	0.230	0.011	0.012	0.016	0.019
Child care	0.591	0.642	0.452	0.377	0.419	0.451	0.331	0.301
Estimated residential population	13 000	30 000	26 700	220 700	546 300	1 163 800	956 900	10 631 400

Notes: Population is aged 25–64 in 2011. Weights refer to the estimated residential population represented by the ACLD sample where all information was provided for both 2006 and 2011. This table presents means for variables measured in 2011. Hence, given that people may identify as Indigenous at one census but not another, the average value for the Indigenous variable does not necessarily equal zero or one. However, less than 5% of Indigenous people changed their Indigenous status between 2006 and 2011.

Source: Author calculations based on the ACLD 2006–2011, which was accessed through the Australian Bureau of Statistics data laboratory.

Evidence from the existing literature shows that, for the Australian population, working-age carers were less likely to be employed before commencing care than people who do not have caring responsibilities. There are likely to be a variety of reasons for this, including the economic argument that caring (where there is a choice) will be allocated to the family member with the lowest labour market opportunity cost and that this will be strongly associated with educational attainment. However, for the Indigenous population, people who were either longer-term or recurrent carers (carers in both 2006 and 2011) had substantially higher levels of educational attainment than Indigenous people who were carers at only one point in time and those without caring responsibilities. For the non-Indigenous population there was no apparent relationship between educational attainment and caring.

We must ask ourselves why people with relatively good economic prospects will be more likely to provide care. It may be something as simple as they are the only household members in a position, or with the resources, to provide care. Whatever the reason for substantial numbers of educated Indigenous people providing longer-term care, it is important to acknowledge that it may circumscribe the capacity to close the gap between Indigenous and non-Indigenous employment.

Given the high level of disability and need for caring in the Indigenous community, it is desirable to have a substantial number of Indigenous people engage in caring (which is, by definition, a socially worthwhile endeavour). The tricky question for policymakers and researchers is whether some of these Indigenous carers would otherwise choose to be actively engaged in the labour market had they not been engaged to provide care. The answer to such questions require analysis that can provide further insights into causal processes. Longitudinal data may provide one avenue for such research, but a mixed-method analysis that interrogates individual circumstances over a longer time (or, at the very least, more observations over time) is likely to be required.

Notes

- Using data from the Household, Income and Labour Dynamics in Australia Survey, Leigh (2010) found that cross-sectional estimates indicate that being an informal carer reduces employment rates by between 8 and 20 percentage points.
- Linked records in the ACLD are identified through probabilistic matching.
- Although the ACLD is a 5% sample of the Australian population, the Indigenous sample is less than 5% of the Indigenous population. The underrepresentation of the Indigenous sample in the ACLD is because of a lower rate of successful linkage for the Indigenous sample.
- In this paper, the term 'employment rate' refers to the proportion of the population that is employed. This clarification is necessary because in the labour economics literature, the 'employment rate' refers to the proportion of the labour force that are employed.
- Since the regression models considered here are nonlinear, the least squares and feasible generalised least squares methods are not appropriate. This is more than an inconvenience in this setting, because it means that we need to consider some tricky specification issues when contemplating the extensions of the fixed and random effects models in the discrete choice modelling context.

The fixed effects model would be specified by the latent variable, $empit^*$:

$$empit^* = \alpha_i + xit'\beta + zi'\gamma + \varepsilon_{it}, \quad t = 1, \dots, T, \quad i = 1, \dots, n$$

where $empit = 1$ if $empit^* > 0$, and $empit = 0$ otherwise.

We have made the distinction between time varying attributes and characteristics, xit , and time invariant characteristics, zi . The common effects, α_i , may be correlated with the included variables, xit . Since the model is nonlinear, the least squares estimator is unusable. The full maximum likelihood estimator for this model is inconsistent, a consequence of the incidental parameters problem. [See Neyman and Scott (1948) and Lancaster (2000).] The problem arises because the number of parameters in the model, α_i , rises with n . With small T or T_i , this produces a bias in the estimator of β that does not diminish with an increase in n . The conditional log likelihood is the sum of the logs of the joint probabilities. Given the conditional log likelihood does not include fixed effects, the resulting estimator has the usual properties, including consistency (i.e. it bypasses the incidental parameter problem – see Willis 2006). However, it does have a major shortcoming in that, by avoiding the estimation of the fixed effects, we have precluded computation of the partial effects or estimates of the probabilities for the outcomes. This property is a significant limitation in the context of this paper in that we want to appreciate the extent to which the probability of being employed is affected by the caring and other relevant factors found in standard human capital models of employment outcomes.

For the random effects model involving a binary choice, the underlying model is:

$$empit^* = xit'\beta + zi'\gamma + \sigma u_{it} + \varepsilon_{it}, \quad t = 1, \dots, T, \quad i = 1, \dots, n,$$

where $E[u_{it}|xit] = 0$, $\text{Var}[u_{it}|xit] = 1$ and, again, $empit = 1$ if $empit^* > 0$ and $empit = 0$ otherwise. That is, in random effects models, the unobserved variables are assumed to be uncorrelated with (or, more strongly, statistically independent of) all the observed variables. In our opinion, the observable random effects are likely to be correlated with the explanatory variables, so the assumptions probably do not hold. Mundlak (1978) proposed a correction for a random effects model that includes average measures for the explanatory variable for each time period. While this would allow us to place more structure on the analysis, it does not alter the basic issue with the specification of the panel model when only two data points are collected over time ($T = 2$).

- There are numerous studies of Indigenous employment, but Gray and Hunter (2012) was chosen as the example because it used synthetic cohort analysis to try to gain some insight into the longitudinal aspects of Indigenous labour force status by tracking cohorts across censuses. That is, before the ACLD, researchers had to construct artificial data to draw indirect conclusions about changes in Indigenous employment outcomes. Tracking individuals across time should facilitate more nuanced insights, especially if information is collected across future censuses for these individuals.
- In technical terms, the estimation is not affected by any endogeneity between the decision to provide care to a PWD and an individual's decisions about labour force status.
- Concordance statistics (i.e. C-stats) were estimated to indicate the adequacy of the logistic models for prediction. The concordance statistic gives the percentage of all possible pairs of cases in which the model assigns a higher probability to a correct case than to an incorrect case. Hosmer and Lemeshow (2000:162) provide guidelines for interpreting the concordance statistic, which indicate that a value of 0.7 is evidence that the model is adequate.
- Section 2 discussed some of the limitations of standard panel data techniques in the context of discrete choice modelling when individuals are only observed at two points in time. Nonetheless, we estimated a fixed effects and random effects logistic model to use more of the longitudinal information in the ACLD, and in a tentative attempt to control for unobservable heterogeneity. These models also provide a robustness check for the logistic models reported above. Both the fixed effects and random effects estimates are statistically significant and consistent with the logistic estimates presented in this paper.
- Given the issues for using panel data techniques identified above, we have not attempted to estimate a dynamic model to directly control for an individual's employment status in 2006.
- In this model, the value of alternative time use is the wage rate the person could earn in the market if employed, and their likelihood of finding employment.

Appendix A Detailed regression results

TABLE A1. Population-weighted summary statistics for summary regression model

Variable	Indigenous	Non-Indigenous
Employed 2011	0.575	0.777
Female	0.571	0.503
Age	42	45
Age squared	1874	2107
Degree	0.086	0.268
Diploma	0.063	0.108
Certificate	0.198	0.208
Year 12 completed	0.126	0.157
Disability	0.059	0.027
Regional area	0.429	0.279
Remote area	0.230	0.020
Child care	0.467	0.397
Carer PWD in both 2006 and 2011	0.051	0.043
Became carer PWD	0.112	0.094
Ceased as carer PWD	0.097	0.071
Estimated residential population	205 282	9 108 695

Note: The population for this table is people aged between 25 and 64 in 2011. Weights refer to the estimated residential population represented by the ACLD sample where all information was provided for both 2006 and 2011. All statistics refer to the averages for 2011 (except the carer of a PWD that combines information from the 2006 and 2011 censuses).

Source: ACLD 2006–2011

TABLE A2. Logit coefficients for eight models

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Female	0.05	-0.36	-0.33	-0.45	-0.41	-0.45	-0.40	-0.66
Age	0.21	0.41	0.14	0.34	0.24	0.33	0.17	0.33
Age squared	-0.002	-0.004	-0.003	-0.004	-0.003	-0.004	-0.003	-0.004
Degree	1.33	0.60	1.12	0.73	1.16	0.67	1.20	0.56
Diploma	0.91	0.31	0.90	0.52	0.88	0.49	0.84	0.36
Certificate	1.01	0.31	0.77	0.37	0.85	0.38	0.90	0.32
Year 12 completed	0.25	0.24	0.35	0.14	0.17	0.16	0.34	0.04
Disability	-1.33	-1.60	-1.63	-1.75	-2.26	-2.54	-2.53	-2.68
Indigenous	-0.23	-0.11	-0.35	-0.76	-0.39	-0.78	-0.63	-0.73
Regional area	0.18	0.07	0.14	-0.07	0.15	-0.04	0.10	-0.05
Remote area	0.48	0.10	0.30	0.02	0.46	0.05	0.48	0.14
Child care	0.10	-0.23	-0.06	-0.26	-0.31	-0.35	-0.29	-0.52
Constant	-5.03	-6.70	-2.81	-5.19	-4.05	-4.31	-2.52	-3.74
Number of observations	5 946	12 071	8 850	29 571	8 068	20 844	58 873	255 743
Correctly classified	76%	84%	69%	83%	71%	86%	70%	89%
C-statistic	0.73	0.68	0.71	0.68	0.77	0.71	0.77	0.70

Note: All models are estimated for the population aged between 20 and 59 in 2006. Bolded coefficients are not significant at the 5% level, using a robust standard errors.

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